# THE LIFE OF *Sir* Iſaac Newton; WITH AN ACCOUNT OF HIS WRITINGS.

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# THE PANEGYRICK OF Sir *ISAAC NEWTON*.

SIR *ISAAC NEWTON* was born at *Wolſtrop* in the County of *Lincoln* on *Chriſtmas-day, O. S.* in the year 1642. He was deſcended of the eldeſt Branch of the Family of Sir *John Newton*, Bart. who were Lords of the Manor of *Wolſtrop*, and have been poſſeſs'd of the Eſtate for near 200 years. The *Newtons* had remov'd thither from *Weſtby* in the ſame County, but originally came from the Town of *Newton* in *Lancaſhire*. His Mother's name was *Anne Ayſcough*, who was alſo of an antient Family, and married again after his Father's Deceaſe.

She ſent her Son to the Free-School of *Grantham* at twelve years old, and took him thence within a few years after, that ſhe might make him early acquainted with his own affairs, and learn to look after them himſelf. But ſhe found him ſo little diſpos'd towards an application for Buſineſs, and ſo entirely given up to his Book, that ſhe ſoon ſent him back to *Grantham*, with free leave to follow his own Inclinations. And theſe he afterwards purſued with the greateſt Satisfaction, by removing from thence to *Trinity College* in *Cambridge*, where he was admitted in 1660. at the age of eighteen.'

In ſtudying Mathematicks, he employ'd his Thoughts very little upon *Euclid*, as judging him too plain and eaſy to take up any part of his time; he underſtood him almoſt before he had read him, and by only caſting his eye upon the Subject of a Propoſition, was able to give the Demonſtration. He launch'd at once into ſuch Books as the Geometry of *Des Cartes* and the Opticks of *Kepler*. So that we may juſtly apply to him what *Lucan* has ſaid of the *Nile*, whoſe Springs were unknown to the Antients, *That it was not granted to Mankind to ſee the* Nile *in a ſmall Stream.* It can be prov'd, that Sir *Iſaac Newton* had made his great diſcoveries in Geometry, and laid the Foundation of his two famous Performances, the *Principia* and the *Opticks*, by that time he was four and twenty years old. If the intelligent Beings, ſuperiour to Man, do alſo make a progreſs in Knowledge, they fly whilſt we creep, and paſs over without notice the intermediate ſteps, by which we ſlowly advance from the perception of one truth to another, which has a dependence upon it.

In 1668. *Nicholas Mercator*, a Native of *Holſtein*, who had paſs'd the beſt part of his time in *England*, publiſh'd his *Logarithmotechnia*, in which he reſolv'd the Area of an Hyperbola into an infinite Series. This was the firſt time ſuch a method of Calculation, ſo dextrouſly drawn from the nature of a particular Curve, had appear'd in the World. The learned Dr. *Barrow*, at that time reſiding at *Cambridge* with Sir *Iſaac Newton*, who was then in his ſeven and twentieth year, recollected ſtreight, that he had ſeen the ſame Theory among the Compoſitions of this young Gentleman, tho' not confin'd to the Hyperbola in particular, but extended by general rules to all ſorts of curvilinear Figures, even to mechanical Curves, to their Quadratures, Rectifications, and Centres of Gravity, to Solids form'd by their Revolutions, and the Surfaces of ſuch Solids; ſo that if the Determinations were poſſible, the Series would terminate at a certain point, or if they did not terminate, their ſums might be had by rule; and if the preciſe Determinations could not be obtain'd, yet nearer approaches might ſtill be made towards Infinity; the happieſt and moſt artful Scheme which the wit of Man could have ever invented for ſupplying the imperfection of his own knowledge.

'Twas a great treaſure for a Mathematician to be poſſeſs'd of ſo fruitful and ſo general a Theory; 'twas a ſtill greater glory to have been the inventor of a Theory ſo ſurpriſing and ingenious; and 'twas natural for Sir *Iſaac Newton*, when he ſaw by *Mercator*'s Book, that he was upon the right purſuit, and that others might follow him in it, to have laid open his treaſure at large, and ſecur'd to himſelf the right of property, ariſing from the diſcovery. But he was ſatisfied with the enjoyment of it, without being at all ſollicitous about the glory attending it. He ſays himſelf in one of his letters in the *Commercium Epiſtolicum*, that *he thought his ſecret had been entirely diſcover'd by* Mercator, *or would have been by others, before he ſhould have been of a proper age to have diſclos'd it*. He ſuffer'd the honour of an Invention to be raviſh'd from him without regret, from whence he might have promis'd himſelf the largeſt returns of praiſe; and tho' he loſt no time in the purſuit of the nobleſt Attempts, yet he waited 'till he was of a convenient age to ſhew himſelf to the World. His Manuſcript was only communicated to Mr. *Collins* and my Lord *Brounker*, who were diſtinguiſh'd by their Skill in theſe matters; and even this could not be obtain'd but by the mediation of Dr. *Barrow*, who would not ſuffer him to indulge his Modeſty to the utmoſt length of his Inclination.

This Manuſcript, which the Author gave out of his hands in 1669. was entitled, *A Method, which I had formerly found out*, &c. Now if the word *formerly* be ſuppos'd only to comprehend three years, this beautiful Theory muſt have been diſcover'd before he was four and twenty years old. The ſame Manuſcript farther contains the Invention and Calculation of Fluxions, which have occaſion'd ſo great a Diſpute between Mr. *Leibnitz* and Sir *Iſaac Newton*, or rather between *Germany* and *England*. We gave the Hiſtory of it in 1716. in our Panegyrick upon Mr. *Leibnitz*; and tho' our buſineſs was then to praiſe Mr. *Leibnitz*, yet we there ſo exactly obſerv'd the Impartiality of an Hiſtorian, that we have nothing more to add at preſent with reference to Sir *Iſaac Newton*. We expreſſly declar'd, that *Sir* Iſ. Newton *was certainly the Inventor*; *that the Glory of it was undoubtedly his due*; *and that the Diſpute was only whether Mr.* Leibnitz *had borrow'd his notion from him*. All *England* is convinc'd that he did, tho' the Royal Society have not been deciſive in their Judgment upon it. Sir *Iſaac Newton*'s Invention preceded the publication of Mr. *Leibnitz* by ſeveral years. Mr. *Leibnitz* on the other hand is the firſt who ever made this Method of Calculation publick; and if he has taken it from Sir *Iſaac Newton*, he has at leaſt reſembled *Prometheus* in the Fable, who ſtole Fire from the Gods, that he might communicate it to Men.

In 1687. Sir *Iſaac Newton* at laſt determin'd to throw off the Veil, and let the World ſee what manner of Man he was; 'twas then he publiſh'd his *Mathematical Principles of Natural Philoſophy*. This Book, in which he has built a new Syſtem of Phyſicks upon the deepeſt reaſonings in Geometry, did not at firſt meet with all the applauſe it deſerv'd, and which it was one day to receive. As it is written with a great deal of learning, as the Author has been very ſparing of his expreſſions, and the concluſions are often ſo haſtily drawn from the premiſſes, that the Reader is frequently left to ſupply an intermediate chain of Conſequences, it requir'd ſome time before the Publick could be able to underſtand it. Mathematicians of character were oblig'd to ſtudy it with care, before they could be maſters of it; and thoſe of a lower rank did not dare to venture upon it, till encourag'd by the more learned; but at laſt, when the Book came to be ſufficiently known, the approbation, which had been ſo ſlowly gain'd, became ſo univerſal, that nothing was to be heard from all quarters but one general cry of Admiration. Mankind were amaz'd at the maſterly Strokes, which ſhone throughout the Work, and ſtood aſtoniſh'd at the vaſt Genius for Invention diſcover'd in it, which in all the Countries of the learned World hardly ever ſhews itſelf in above three or four Perſons during the whole extent of a moſt fruitful Age.

There are two principal Theories, which prevail above the reſt in the *Principia Mathematica*, the doctrine of centripetal Forces, and of the reſiſtance of Fluids to Bodies moving in them; theſe are both almoſt entirely new, and treated of according to the Author's ſublime method of reaſoning in Geometry. There's no poſſibility of touching upon either of theſe points without having Sir *Iſaac Newton* before our eyes, without copying from him, or treading after him, and

ſhould

ſhould we endeavour to conceal it, 'twould be hardly practicable with all our addreſs to prevent its being known.

The relation obſerv'd by *Kepler* between the revolutions of the heavenly Bodies, and their diſtances from the centre of thoſe Revolutions, holds good throughout the whole celeſtial Syſtem. If we ſuppoſe, as we neceſſarily muſt, that a certain force reſtrains thoſe great Bodies from proceeding to move according to their natural direction in a right line from Weſt to Eaſt, and draws 'em continually towards a particular Centre, it will follow from *Kepler*'s rule, that this central or centripetal Force will have a different action upon the ſame Body according to its different diſtances from this centre, and that in a reciprocal proportion of the ſquares of thoſe diſtances; ſo as, for inſtance, if the Body be twice as far diſtant from the Centre of its revolution as before, the action of the central Force upon it will be four times leſs. Sir *Iſaac Newton*'s Syſtem ſeems to have been founded upon this Obſervation. We may alſo ſuppoſe or imagine that the Moon firſt fell under his conſideration, as it has the Earth for the centre of its Motion.

Were the Moon to loſe all the impulſe, by which it has a tendency to move in a right line from Weſt to Eaſt, and the central Force only, by which it is drawn towards the centre of the Earth, were left remaining, 'twould ſolely obey that Force, and following its direction only, would move in a right line towards the centre of the Earth. The motion of its revolution being known, Sir *Iſaac Newton* demonſtrates that by this motion it would deſcribe 15 *Paris* feet in the firſt minute of its deſcent. The diſtance of the Moon from the Earth is 60 of the Earth's ſemidiameters; by that time therefore it would have arrived at the ſurface of the Earth, the action of the Force, which brought it thither, would be encreas'd by the ſquare of 60, that is, it would be

3600 times greater than in the firſt minute, and thus the Moon in the laſt minute would deſcribe 3600 times 15 feet.

Now if we ſuppoſe, that the force acting upon the Moon is the ſame with that which we call Gravity in Bodies upon Earth, it would follow from the Syſtem of *Galileo,* that the Moon, which upon its coming to the Earth would have deſcrib'd 3600 times 15 feet in one minute, muſt alſo have deſcrib'd 15 feet in the firſt 60th part, or in the firſt ſecond of that minute. Now we learn from Experiments, which indeed can only be made at ſmall diſtances from the Earth's ſurface, that heavy Bodies let fall upon the Earth deſcribe 15 feet in the firſt ſecond of their fall. They are therefore, with reſpect to the times of their deſcent, preciſely in the ſame caſe, as if having made the ſame revolution round the Earth as the Moon, and at the ſame diſtance, they were let fall by the ſole force of their Gravity: If then they are in the ſame caſe with the Moon, the Moon is in the ſame caſe with them, and is only drawn towards the centre of the Earth every moment by the force of the ſame Gravity. So exact a conformity, or rather ſo perfect an identity, of Effects can only ariſe from an identity of cauſes.

'Tis true, that in the Syſtem of *Galileo,* which we have hitherto follow'd, Gravity is ſuppoſed to be every where the ſame, whereas the centripetal force of the Moon is ſhewn to be different in the very demonſtration we have juſt now given. But the reaſon is, that in all our Experiments the greateſt height, from whence we can let any Bodies fall, bears no proportion to the diſtance of 1500 Leagues, they are all at from the centre of the Earth. 'Tis demonſtrable, that a Canon-ball diſcharg'd horizontally, upon the ſuppoſition of an uniform Gravity, deſcribes a Parabola, which is terminated in one point by the place where it firſt falls to the Ground; but was it diſcharg'd from an eminence high enough

enough to make the inequality of the action of Gravity ſenſible, it would deſcribe an Ellipſis inſtead of a Parabola, which would have the centre of the Earth for one of its Focus's, that is, it would do exactly the ſame thing as the Moon does.

If the Moon is heavy after the ſame manner as all Bodies upon Earth are heavy; if it is drawn towards the Earth by the ſame force, which draws them thither; if according to Sir *Iſaac Newton*'s expreſſion it gravitates towards the Earth, the ſame principle prevails throughout all the wonderful ſyſtem of the heavenly Bodies; for all nature is exactly the ſame, the like uniform diſpoſition is every where to be diſcern'd, the ſame Ellipſes deſcrib'd by Bodies moving round another Body, which is plac'd in one of their Focus's. The Satellites of *Jupiter* gravitate towards *Jupiter*, as the Moon gravitates towards the Earth, the Satellites of *Saturn* towards *Saturn*, and all the Planets together towards the Sun.

We are ignorant wherein the nature of Gravitation conſiſts, nor was Sir *Iſaac Newton* himſelf acquainted with it. If Gravitation is caus'd by impulſe, we may conceive a piece of falling Marble to be impell'd towards the Earth, without the Earth's having any tendency to move towards the Marble; and in a word, all the Centres, to which the motions ariſing from Gravitation are directed, may be ſuppos'd immoveable. But if it acts by Attraction, the Earth cannot attract the piece of Marble, without the reciprocal action of the Marble upon the Earth; for why ſhould any particular Bodies be endued with an attractive power rather than others? Sir *Iſaac Newton* ſuppoſes the action of Gravitation to be conſtantly reciprocal in all Bodies, and proportional only to the quantities of matter contain'd in 'em, and by this means he ſeems to determine, that Gravitation is in reality an Attraction. 'Tis this word only he makes uſe of upon all occaſions to denote the active force there is in Bodies; a force unknown indeed, and which he does not pretend to define; but if it could alſo act by impulſe, why did he not rather make choice of the clearer expreſſion, ſince all will allow that they are of too different a nature to be uſed promiſcuouſly? The perpetual uſe of the word Attraction, ſupported by ſo great an authority, and perhaps alſo by Sir *Iſaac Newton*'s own inclination for the thing itſelf, at leaſt renders an idea familiar to his readers, which the Carteſians had rejected, and all other Philoſophers had condemn'd; we muſt therefore be upon our guard not to look upon it as a reality, as we are expoſed to the temptation of believing that we underſtand it.

But be this as it will, all Bodies, according to Sir *Iſ. Newton,* gravitate towards one another, or attract one another in proportion to the quantities of matter contain'd in 'em; and in revolving about a common Centre, by which they are conſequently attracted, and which they mutually attract, their attractive forces vary in a reciprocal proportion of their diſtances from that Centre; and if all together with their common Centre revolve about another Centre which is common to others with them, new relations muſt hence ariſe, which will form a ſurpriſing complication. Thus every ſingle Satellite of *Saturn* gravitates towards the other four, and the other four gravitate towards the fifth; all the five gravitate towards *Saturn,* and *Saturn* towards them; they all gravitate towards the Sun, and the Sun towards them all. What an immenſe skill in Geometry muſt have been requiſite to unravel the intricacies of ſo many different relations? It ſeems to have been a bold attempt to have undertaken it; and one cannot without amazement conſider, that from ſo abſtracted a Theory, form'd of ſo many particular Theories, and all of 'em puzzled with difficulties, concluſions ſhould always ariſe exactly conformable to ſuch facts, as have been eſtabliſh'd by Aſtronomy.

Nay farther, upon ſome occaſions, facts, to which Aſtronomers had not ſufficiently attended, ſeem to have been preſag'd by theſe concluſions. It has been alledg'd for ſome time paſt, and eſpecially in *England*, that when *Saturn* and *Jupiter* are in their greateſt proximity, tho' then their diſtance is 165 millions of leagues, their motions are not ſo regular as in the reſt of their courſe; and Sir *Iſaac Newton*'s Syſtem at once aſſigns the reaſon for it, which no other Syſtem but his could ever account for. *Jupiter* and *Saturn* do then attract one another with the greater force, becauſe they are nearer to each other, and by this means the regularity of their courſe is ſenſibly affected: And even the quantity and bounds of this irregularity are capable of being determin'd.

The Moon is the moſt irregular of all the heavenly Bodies, the exacteſt Tables very often fall ſhort of pointing out her courſe, and we are frequently at a loſs to account for the variety of her wanderings. Dr. *Halley*, whoſe profound skill in Mathematicks is no hindrance to his being a good Poet, ſays in the verſes he has ſet before the 3d Edition of Sir *Iſaac Newton*'s Principia, *that the Moon had not till then been ſubject to the reins of any Calculation, nor ſubdued by any Aſtronomer*, but that at laſt ſhe had ſubmitted to Rule in this new Syſtem. All the irregularities of her courſe are there ſo neceſſary, as to become capable of being foretold; and 'tis hardly poſſible that a Syſtem, which ſo readily accounts for 'em, ſhould not be a juſt one, if we conſider 'em eſpecially as the ſmall part of a whole, in which an infinite number of other appearances are explain'd with the like happy ſucceſs. The flux and reflux of the Sea ſeem ſo naturally to ariſe from the joint actions of the Sun and Moon upon the Waters, that this once ſurpriſing Phænomenon appears now to be no longer wonderful.

The other Theory, upon which the *Principia* turns, is the doctrine of the Reſiſtance of Fluids to Bodies moving in 'em; and this muſt neceſſarily take in ſome of the principal Phænomena of Nature, ſuch as the motions of the heavenly Bodies, Light, and Sound. Sir *Iſaac Newton* has diſtinctly examin'd upon geometrical Principles the effects of this reſiſtance ariſing from the ſeveral conſiderations of the denſity of the Medium, the velocity of the moving Bodies, and the magnitude of their Surfaces; and has at laſt drawn concluſions from 'em, which are abſolutely inconſiſtent with the Vortices of *Des Cartes*, and quite overturn that mighty celeſtial Pile, which had formerly been lookt upon as impoſſible to be ſhaken. If the Planets move round the Sun in any fluid whatſoever, let the ethereal matter which fills up all Space be never ſo ſubtle, the Bodies moving in it cannot but demonſtrably find ſome reſiſtance; and if ſo, whence comes it to paſs, that the motions of theſe Planets are not perpetually and even ſuddenly impair'd? Or how can the Comets ſo freely move acroſs theſe Vortices in directions contrary to the motions of the vortical Fluid, without any ſenſible alteration in their motions? Or is it poſſible, that theſe immenſe Torrents, moving with an almoſt incredible rapidity, ſhould not in an inſtant abſorb all the motion of a particular Body, which is but as an Atom in compariſon with them, and forcibly carry it along with 'em in their circumvolution?

The heavenly Bodies do therefore move in a void ſpace, except that the Exhalations ariſing from 'em in conjunction with the Rays of Light, which variouſly intermix with each other, interſperſe a ſmall quantity of matter in the almoſt infinite portions of immaterial ſpace. The Vacuum and Attraction, which had been baniſh'd by *Des Cartes* from the phyſical World, and to all outward ſeeming were baniſh'd for ever, are brought back again by Sir *Iſaac Newton* arm'd with a new force, of which they had been judg'd incapable, and perhaps only a little chang'd in appearance.

The two great Men, who are here found in ſo great an oppoſition, did in many reſpects very much reſemble each other. They were both of 'em men of a ſuperlative genius, born to command over others, and to lay the foundation of Empires: Both of 'em were excellent Mathematicians, and ſaw the neceſſity of introducing Geometry into Phyſicks; and both of 'em form'd their Syſtems upon geometrical Reaſonings, which they ow'd almoſt entirely to themſelves. But the one was for taking a bold flight, and placing himſelf at the fountain-head reſolv'd to ſubject even firſt Principles to certain clear and fundamental Ideas of his own, from whence he would deduce the appearances of Nature as ſo many conſequences from his poſitions. Whilſt the other with more caution and modeſty began with obſerving the operations of Nature, and gradually advancing to unknown principles, with a reſolution to admit of ſuch only as might be ſupplied by a chain of conſequences. The one proceeds from what he clearly underſtands, to find out the cauſe of what he ſees: And the other from what he ſees to find out the cauſe, whether plain or obſcure. The evident principles of the one do not always conduct him to appearances ſuch as in reality they are; and appearances do not always lead the other to ſuch principles as are ſufficiently evident: Whilſt the limits, which in theſe two oppoſite methods could put a ſtop to the farther progreſs of two ſuch men as theſe, are not the limits of their own, but of human Underſtanding.

At the ſame time that Sir *Iſaac Newton* was engag'd upon his great work of the *Principia*, he had another on his hands, altogether as much an Original as the former; and tho' leſs general in the title, yet as extenſive in the manner he deſign'd to handle it. 'Tis his *Opticks*, or *Treatiſe of Light and Colours*, which firſt came abroad in 1704. after the Author had ſpent 30 years in making the Experiments, he judg'd neceſſary to compleat it.

'Tis no eaſy matter to be able to make an Experiment with accuracy. The leaſt fact, which offers itſelf to our conſideration, takes in ſo many other facts, which modify or compoſe it, that it requires the utmoſt dexterity to lay open the ſeveral branches of its compoſition, and no leſs ſagacity to find 'em out. It muſt be ſubdivided into other facts, which are themſelves compounded; and unleſs we have at firſt fallen upon a right method of purſuit, we ſhall find our ſelves very often involv'd in unextricable difficulties. Original and elementary facts ſeem to have been conceal'd from us by nature with as much care as their cauſes, and when once we come to diſcover 'em, the view is entirely new, and altogether unforeſeen.

The conſtant object of Sir *Iſaac Newton*'s Opticks is the Anatomy of Light. The expreſſion is not too bold, nor more comprehenſive than the thing itſelf. A very ſmall Beam of Light, admitted into a dark room, which yet can never be ſo ſmall as not to conſiſt of an infinite number of Rays, is divided and diſſected, ſo as to give the elementary Rays, of which it is compos'd, diſtinct from each other, and differing in colour, which ſhall after that ſeparation remain unalterable; the whiteneſs of the undivided beam before its diſſection reſulting from the intermixture of all the particular colours of the original rays. This ſeparation of rays has been found ſo difficult, that when Mr. ***Mariotte*** attempted it upon the firſt report of Sir *Iſaac Newton*'s Experiments, he fail'd of ſucceſs, tho' he had ſo remarkable a genius for making Experiments, and had ſucceeded ſo well on ſo many other occaſions.

'Twould have been impoſſible to have ever ſeparated the primary-colour'd Rays, if they had not been naturally diſpoſed to an inequality of Refraction, in paſſing thro' the ſame medium, the ſame glaſs priſm, and by that means to be diſunited, when receiv'd at convenient diſtances. This different Refrangibility of red, yellow, green, blue, violet, and the vaſt variety of intermediate-colour'd Rays, a property which had never been ſuſpected, and which no conjecture could have ever form'd, is the fundamental Diſcovery in Sir *Iſ. Newton*'s Treatiſe. From the different Refrangibility we are led to the different Reflexibility; and what is ſtill more curious, the ſame ſort of Rays at equal angles of incidence on any thin tranſparent plate are alternately reflected and tranſmitted for many ſucceſſions; a kind of ſport, which could never have been diſtinguiſhed but by a very good eye, aſſiſted by a very good judgment. And laſtly, (in which point only the firſt thought was not Sir *Iſaac Newton*'s) the Rays which paſs near the edges of Bodies without touching them, do not paſs by them in right lines, but are ſomewhat turn'd aſide, and form that ſort of bending which he calls Inflection. From all which obſervations taken together, he has drawn up a ſyſtem of Opticks, ſo perfectly new, that this Science muſt be always look'd upon hereafter as almoſt entirely owing to this great Author.

And, that he might not be wholly confin'd to ſpeculations, which are ſometimes unjuſtly cenſur'd as mere Amuſements, he has farther given us the invention and deſign of a reflecting Teleſcope, tho' it was not well executed till ſome time after. We have ſeen here, that ſuch a Teleſcope, of no more than two foot and a half long, has magnified as much as a good common Teleſcope of eight or nine foot long; a conſiderable advantage, and ſuch as our poſterity will undoubtedly be more ſenſible of hereafter, than we can be at preſent.

One benefit ariſing from this performance, and which perhaps may be as momentous as any other branch of knowledge contain'd in it, is, that it ſupplies us with an excellent model how we ſhould proceed in experimental Philoſophy. Whenever we are to ſearch into Nature by Experiments and Obſervations, we muſt follow Sir *Iſaac Newton*'s example, and act with the ſame caution and exactneſs that he has done. He has by a peculiar happineſs reduc'd to calculation ſuch matters, as ſeem'd too nice to be the ſubject of any enquiry; and to ſuch a calculation, as the greateſt skill in Geometry alone could never have effected. The application he has made of his Geometry is as curious, as his Geometry itſelf is ſublime.

He did not finiſh his Opticks, becauſe he was interrupted in the courſe of Experiments, which he judg'd neceſſary, and had not time to take the ſubject again into his conſideration. And 'twill require almoſt as able hands as the firſt Architect to compleat the unfiniſh'd Building. However he has given directions, as much as was poſſible, to ſuch as ſhould be willing to extend their enquiries farther than he has done, and has even pointed out the way for paſſing from a Courſe of Opticks to an entire Syſtem of Phyſicks. Under the form of Queries he propoſes a great variety of hints, which may be ſerviceable to Philoſophers hereafter, or will at leaſt contain the firſt thoughts of a great Philoſopher, which will always be an entertainment to the curious.

Attraction is the prevailing principle in this ſhort Abridgment of a Syſtem of Phyſicks. The force in Bodies which we call *hardneſs*, is no other than the mutual attraction of their particles, which cauſes 'em to adhere cloſely together; and if they are of ſuch a figure, as to touch one another on all ſides without leaving any interſtices between, they are Bodies perfectly hard. Of this ſort only are the primary, unalterable particles, of which all other Bodies are compos'd. Chymical fermentations, or effervеſcencies, whoſe motions are ſometimes ſo violent, as not improperly to be compar'd to Hurricanes, are the effects of this powerful attraction, which acts in very ſmall bodies only at very ſmall diſtances.

In general he is of opinion, that Attraction is the active principle of univerſal Nature, and the cauſe which puts all Bodies into motion. For were a certain quantity of motion, originally impreſs'd upon matter by God Almighty, to be differently diſtributed according to the known laws of motion, it evidently appears that this motion would be continually decreaſing from the contrary impreſſions of Bodies ſtriking againſt each other, without any poſſibility of its being recruited; and thus the Univerſe would ſoon fall into a ſtate of inactivity, which would be the general decay of the whole; whilſt the power of attraction always ſubſiſting, without any diminution of its force, will conſtantly furniſh a perpetual ſupply of life and action. Tho' indeed it may ſo happen, that the particles of matter may enter into ſuch new aſſociations thro' the variety of their attractions, that conſiderable irregularities may be produc'd from thence in the frame of Nature, and this Syſtem, according to Sir *Iſaac Newton*'s expreſſion, may ſtand in need of a Reformation.

He expreſſly declares, that he does not aſſign Attraction as a cauſe that he is able to account for, but only that he conſiders, compares, and calculates the effects of this principle; and to avoid the imputation of introducing again the occult Qualities of the Schoolmen, he ſays, that he derives only manifeſt and very ſenſible Principles from Phænomena, tho' in reality the cauſes of thoſe Principles are not yet diſcover'd, and he leaves 'em to be found out by other Philoſophers. But were not the occult Qualities of the Schoolmen Cauſes, and did they not apparently ſee the Effects? Or did Sir *Iſaac Newton* believe, that the occult Cauſes, which he has not been able to diſcover himſelf, would be found out by others? Or has he given us any encouragement to enquire after 'em?

He has added at the end of his Opticks two Treatiſes, which are purely mathematical, the one about ſquaring curvilinear Figures, and the other entitl'd, *Enumeratio Linearum tertii ordinis*. He has ſince omitted 'em, as not belonging to the Subject of his Book; and in 1711. they were printed ſeparately with his *Analyſis per Quantitatum ſeries, Fluxiones, ac differentias*. And I ſhall only add this remark concerning 'em, that in all theſe Performances he has diſcover'd a Genius and Skill in Geometry, which were peculiar only to himſelf.

A perſon ſo entirely given up to ſpeculation may naturally be ſuppos'd to have been both indifferent towards buſineſs, and uncapable to manage it. And yet in the year 1687. the year he publiſh'd his *Principia*, when the privileges of the Univerſity of *Cambridge*, where he had been Profeſſor of Mathematicks from the year 1669. by the reſignation of Dr. *Barrow* in his favour, were attack'd by King *James* II. he was one of the moſt zealous to maintain 'em, and was accordingly nominated one of the Delegates of the Univerſity to the High-Commiſſion Court. He was alſo choſe Member of Parliament in the Convention of 1688. and held his ſeat there till it was diſſolv'd.

In 1696. the Earl of *Halifax,* Chancellor of the Exchequer, and the great Patron of the Learned (for the *Engliſh* Noblemen don't make a merit of their diſregard to Letters, but are often Men of Learning themſelves) obtain'd of King *William* to make Sir *Iſaac Newton* Keeper of the Mint, in which office he did him very ſignal Services at the time the Money was call'd in to be recoin'd. And about three years after he was advanc'd to be Maſter of the Mint, an employment of a conſiderable value, which he held till the day of his death.

'Tis reaſonable to ſuppoſe, that he was fix'd in this poſt becauſe of his great skill in Geometry and Natural Philoſophy; and indeed 'tis an affair which very often demands both difficult Calculations and a great number of chymical Experiments; and he has given proofs of his Abilities this way in the Table of Aſſays of foreign Silver, which he printed at the end of Dr. *Arbuthnot's* Book: 'Tho' his Genius cannot but have extended farther, and reach'd even to matters purely political, without any intermixture of ſpeculative knowledge. In 1701. he was again choſe Member of Parliament for the Univerſity of *Cambridge.* And perhaps after all it may be a miſtake to look upon Learning and Buſineſs as ſo inconſiſtent with each other, eſpecially in Men of a certain diſpoſition. For political Affairs, if well underſtood, are naturally reduc'd into certain nice Calculations and Combinations, which minds accuſtom'd to deep Speculations do more eaſily and ſurely comprehend, from the time they are made acquainted with the proper facts, and furniſh'd with the neceſſary materials.

Sir *Iſaac Newton* has had the ſingular good fortune to enjoy the honours he deſerv'd in his own life-time, very different from *Des Cartes*, who did not receive 'em till after his death. The *Engliſh* are not apt to pay the leſs regard to great Abilities for being of their native growth; but inſtead of endeavouring to leſſen 'em by injurious reflections, or approving the envy which attacks 'em, they all join together in ſtriving to advance 'em; and that exceſs of Liberty, which divides 'em upon ſubjects of the greateſt importance, is no hindrance to their unanimity in this. They are all ſenſible that a great Genius muſt reflect honour upon the State, and whoever is able to procure it to their Country, is upon that account infinitely dear to 'em. All the learned Men of a Nation, which abounds in Men of Learning, plac'd Sir *Iſaac Newton* at their head by a kind of general conſent; they acknowledg'd him for their Maſter and Chief, not a Rebel dar'd to riſe up againſt him, nor did they admit of ſo much as a cool Admirer. His Philoſophy was embrac'd by all *England*; it prevails in the Royal Society, and in all the excellent productions of its Members, as tho' it had been already conſecrated by the veneration of a long ſucceſſion of Ages. He was reverenc'd in ſhort to ſo great a degree, that death could not add any new honours to him; he liv'd to ſee his own Apotheoſis. *Tacitus*, who has reproach'd the *Romans* with their extreme indifference towards the great Men of their own Nation, would have given the *Engliſh* the quite contrary commendation. In vain might the *Romans* have excus'd themſelves by urging, that great merit was become familiar to 'em; *Tacitus* would have anſwer'd, that great merit was never common, or at leaſt they ſhould, if poſſible, have endeavour'd to make it ſo by the glory that ſhould have attended it.

In 1703. Sir *Iſaac Newton* was choſen Preſident of the Royal Society, and continued in the chair for three and twenty years without interruption 'till the day of his death; a ſingle inſtance; nor did they apprehend they had any reaſon to fear the conſequences.

In 1705. he was knighted by Queen *Anne*, a title of honour, which at leaſt implies, that his name had reach'd as far as the Throne, where the names of the moſt eminently learned do not always arrive.

He was more known at Court than ever under the reign of King *George*. The Princeſs of *Wales*, the preſent Queen of *England*, was too well acquainted with his character not to enquire after him, or be ſatisfied, 'till ſhe had ſeen him. She has oft been heard to declare in publick, that ſhe thought her ſelf happy in having been born in the ſame age, and converſ'd with him. In how many ages, and how many other countries might he have liv'd, without finding there a Princeſs of *Wales!*

He had written a Treatiſe of antient Chronology, which he did not care to publiſh; but the Princeſs, with whom he entruſted the particulars of his deſign, found 'em ſo ingenious, that ſhe was deſirous to have an abridgment of the whole Work, which was never to go out of her hands, but to be reſerv'd only for her private uſe: And ſhe ſtill keeps it as one of the greateſt Treaſures ſhe has in her poſſeſſion. However a Copy of it got abroad, as 'twas natural that a Curioſity rais'd by the expectation of ſo valuable a fragment of Sir *Iſaac Newton's*, ſhould take all imaginable pains to purchaſe it; and 'twould be too ſevere a cenſure in us, to condemn the attempt. This Copy was brought over into *France* by the perſon who was ſo fortunate as to obtain it, and the eſteem he put upon it prevented his keeping it up ſo cloſely as might have been deſir'd. 'Twas ſeen, tranſlated, and at laſt printed.

The principal point in Sir *Iſaac Newton's* Chronology, ſo far as we are able to collect from the Abridgment, is, by ſome cloſe reaſonings upon the faint remains we have left us of the old *Greek* Aſtronomy, to find out the Poſition of the Equinoctial

noctial Colure in the time of *Chiron* the Centaur with reference to the fix'd Stars. As we are now ſatisfied that theſe Stars change their Longitude one degree in about ſeventy two years, could we once learn thro' what Conſtellation the Colure paſs'd in the time of *Chiron*, by taking the diſtance from the preſent Equinoctial Point, we might be able to find out the number of years which have paſs'd ſince *Chiron*'s age. *Chiron* was concern'd in the famous expedition of the *Argonauts*; and therefore this diſcovery would fix the *Epocha* of the *Argonautick* expedition, and by a neceſſary conſequence the Æra of the *Trojan* War, upon which two great events all the antient Chronology does entirely depend. And Sir *Iſaac Newton* places 'em five hundred years nearer to the birth of Chriſt than other Chronologers generally do. This Syſtem has been oppos'd by two learned Gentlemen in *France*, who have been blam'd by the *Engliſh* for being too forward with their Criticiſms, in not having waited till the publication of the entire Work. But this very forwardneſs has done honour to Sir *Iſaac Newton*. They laid hold of the firſt opportunity, which could offer 'em the glory of contending with ſo great an Adverſary; and they have found others to riſe up in his ſtead. The learned Dr. *Halley*, firſt Aſtronomer to the King of *Great Britain*, has already written in defence of the Aſtronomical part of the Syſtem; and his regards for his deceaſed Friend, and his perfect knowledge of the Subject, muſt render him a formidable Opponent. The diſpute however is not yet ended, the very few who are judges of the affair, have not decided it; and if it ſhould ſo happen, that the ſtrongeſt Arguments ſhould lie on one ſide, and the name of Sir *Iſaac Newton* on the other, the publick, 'tis probable, would remain ſome time in ſuſpence, and perhaps might be excuſable for doing ſo.

As ſoon as the Academy of Sciences were impower'd by the regulations which paſs'd in 1699, to add foreigners to their Society, they did not fail to make choice of Sir *Iſaac Newton*.

*Newton*. He held a conſtant correſpondence with 'em by ſending over to 'em whatever he publiſh'd. Theſe were his former labours, which he either cauſed to be reprinted, or were then ſent abroad for the firſt time: For after he was employ'd in the Mint, which had been for ſome years before, he engag'd in no conſiderable undertaking in Mathematicks or Philoſophy. For tho' the ſolution of the famous Problem about the *Trajectoria*, which was propoſed to the *Engliſh* by *M. Leibnitz* as a Challenge, during his diſpute with them, and had been carefully ſought out by him as an intricate and difficult Propoſition, might paſs for a conſiderable Production, yet it was no more than a mere Amuſement to Sir *Iſaac Newton*. He received the Problem at four in the evening, as he was returning from the Mint fatigued with buſineſs, and finiſh'd the ſolution before he went to bed. And now, having been ſo ſerviceable to all the learned in *Europe*, by the improvements he had made in ſpeculative knowledge, he gave himſelf up entirely to the ſervice of his Country by an application to buſineſs, that was attended with a more direct and ſenſible advantage, an employment which muſt affect every good Citizen with a viſible pleaſure; but if at any time he had any leiſure hours, he would then give way to his curioſity, and thought no ſcorn of any ſort of knowledge, but knew how to reap a benefit from all. There were found amongſt his papers abundance of diſcourſes after his death, upon ſubjects of Antiquity, Hiſtory, and even Divinity, tho' ſo remote from the Sciences for which he was diſtinguiſh'd. He ſuffer'd no moments to paſs by him idly; nor whilſt he was employ'd, could he be content with a ſlight application.

He liv'd in perfect health, till he was above fourſcore years old, a very material circumſtance of the ſingular happineſs he enjoy'd. He then began to complain of an involuntary Flux of Urine; tho' for the five years after, which preceded his death, he had great intervals of health or eaſe, procur'd by the obſervance of a ſtrict regimen, and cautions he had no need of before. He was oblig'd to rely upon Mr. *Conduit*, who had married his Niece, for the diſcharge of his office at the Mint; and this he did upon the fulleſt aſſurances, that he committed ſo important a truſt to very able hands. His judgment has been confirm'd ſince his death by the King's choice, who has confer'd the place upon Mr. *Conduit*. Sir *Iſaac Newton* was a ſtranger to pain till the laſt twenty days of his life. 'Twas certainly judg'd that he had the Stone, and could not poſſibly be cur'd. And tho' the paroxyſms were ſo violent, that large drops of ſweat have run down his cheeks, he was never heard to utter a groan, or give any ſign of impatience; and as ſoon as he had a moment's eaſe, he would ſmile, and diſcourſe with his uſual cheerfulneſs. Till this time he had conſtantly read or wrote ſeveral hours every day. He read the News-Papers of *Saturday* the 18th of *March O. S.* in the morning, and talk'd a long time with the celebrated Phyſician Dr. *Mead*; he was perfectly in his ſenſes, and enjoy'd his underſtanding to the utmoſt; but towards evening he loſt 'em quite, and never afterwards recover'd 'em; as if the faculties of his Soul had been ſubject only to a total extinction, and not liable to any decay. He died the *Monday* following on the 20th of *March*, in the 86th year of his age.

His body lay in State in the *Jeruſalem* Chamber, from whence perſons of the higheſt rank, and ſometimes crown'd Heads have been carried to their graves. He was convey'd from thence into *Weſtminſter-Abbey*, the Pall being held up by the Lord Chancellor, the Dukes of *Montroſe* and *Roxburgh*, and the Earls of *Pembroke*, *Suſſex* and *Macclesfield*. From theſe ſix *Engliſh* Peers, who diſcharg'd this ſolemn office, we may form a judgment of the great number of perſons of diſtinction, who muſt have had a ſhare in the pomp of the

Funeral.

Funeral. The Biſhop of *Rocheſter* read the ſervice, attended by all the Clergy of his Church. The Corps was interr'd near the entrance into the Choir. We muſt go back almoſt as far as the antient *Greeks*, if we would find a like inſtance of ſo great a veneration paid to Learning. Sir *Iſaac Newton*'s family have farther imitated the example of *Greece*, by erecting a noble Monument to his memory, upon which they are about to beſtow a conſiderable ſum. The Dean and Chapter of *Weſtminſter* have given leave that it ſhall be rais'd in a part of the Abby, which has been refus'd to perſons of the firſt Quality. His Country and Family have paid him the ſame regards, as if he had made choice of them himſelf.

He was of a mean Stature, and a little inclin'd to fulneſs in his later years, of a quick and piercing eye, with a countenance at the ſame time venerable and engaging, eſpecially when he would throw off his Perruque, and ſhew his ſilver Hairs, which hung down in large locks upon his ſhoulders. He never made uſe of ſpectacles, nor loſt any more than one ſingle Tooth during his whole life. His name will juſtify our deſcending to theſe minute particulars.

He was naturally of a peaceable diſpoſition, and paſſionately fond of his quiet. He would have rather choſe to have lain in obſcurity, than to have ſeen the calm of his life diſturb'd by the wranglings and diſputes, which are the certain conſequences of being eminent. We learn from one of his Letters in the *Commercium Epiſtolicum*, that when his Treatiſe of Opticks was ready for the Preſs, certain haſty objections, which had been rais'd againſt it, made him lay aſide the deſign for that time. *I blam'd my imprudence*, ſays he, *for parting with ſo valuable a bleſſing as my quiet, to run after a ſhadow.* But that ſhadow did not afterwards eſcape him, nor did it coſt him the quiet he ſo much valued,

valued, but prov'd as real an happineſs as the quiet itſelf.

With this diſpoſition we may naturally ſuppoſe that he was modeſt in his deportment; and this character he is ſaid to have always preſerv'd without any alteration, tho' the whole world was conſpir'd againſt it. He never talk'd either of himſelf or others, nor ever behav'd in ſuch manner as to give the moſt malicious obſervers the leaſt ſuſpicion of his vanity. And tho' the general approbation of mankind might have ſpar'd him the pains of publiſhing his own merit, yet how induſtrious would many others have been to have taken a ſhare in ſo grateful a task, which moſt are ſo unwilling to refer to the judgment of another? How many great men, who have gain'd the applauſes of the World, have ſpoil'd the muſick of their praiſes by running out into their own commendations?

He was plain and affable, and open in his dealings with all mankind. Men of the beſt Underſtanding do never overlook what's plac'd below 'em, tho' others are too apt to deſpiſe what's plac'd above 'em. He never thought himſelf diſcharg'd by his merit or reputation from the common offices of life; nor ſtrove by any ſingularity, either natural or acquir'd, to diſtinguiſh himſelf from other men.

Tho' he firmly adher'd to the Church of *England*, he was always averſe to the perſecution of the Non-Conformiſts. He judg'd of men by their manners, and the true Non-Conformiſts with him were the wicked and the vicious. Not that he was addicted only to natural Religion, for he was thoroughly perſuaded of the truth of Revelation; and amongſt the variety of Authors, which he was continually reading, the Book he had moſt conſtantly in his hands was the Bible.

The plenty he enjoy'd from a large Patrimony and a conſiderable Employment, advanc'd by the plainneſs and frugality of his way of life, gave him a fair opportunity of encreaſing his Revenue. He thought it no gift to give by will, and for this reaſon he left none behind him; tho' he would diſtribute large ſums in his life-time in preſents to his Relations, or to perſons whom he knew to ſtand in need of his aſſiſtance. The inſtances of his liberality in this way are neither few nor inconſiderable. When decency requir'd him at any time to launch out into expence and dreſs, he would never ſpare for magnificence, but appear always in a manner ſuitable to the occaſion. At all other times he was an utter enemy to pomp and figure, which ſeems great only to little minds, and reſerv'd his income for more important uſes. 'Twould indeed have been ſomewhat extraordinary, that a mind accuſtom'd to reflection, and train'd up to a courſe of reaſoning, ſhould at the ſame time have been fond of Shew, and in love with Extravagance.

He liv'd always ſingle, and perhaps had no time to think of marriage, deep ſunk at firſt in a ſevere and conſtant courſe of ſtudy during the prime of life, and afterwards engag'd in the hurry of a conſiderable Employment, and it may be ſo taken up with an intenſeneſs of thought, that he had no vacancy left him in life, nor any occaſion for a companion at home.

He left behind him to the value of two and thirty thouſand pounds ſterling, which amounts to ſeven hundred thouſand Livres of *French* Money. His Competitor Mr. *Leibnitz* died rich alſo, but far inferior to him, and with a conſiderable ſum in reverſion *. Theſe two extraordinary inſtances, and both of 'em in Foreigners, ſeem to deſerve our attention.

*F I N I S.*

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* *See the Hiſt. of the Royal Acad. for the year* 1716. *p.* 128.

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